"Apparatus and Method for Panel Construction"

Field of the Invention

The present invention relates to an apparatus and method for panel construction. In particular it relates to a technique for the manufacture of a plurality of panels.

Background Art

Precast concrete panels have been used in construction for a long time. Panels may be formed offsite off-site and transported to site for erection or may be formed on-site and moved into position when ready. Usually, the design of a building using such panels calls for a significant number of identical panels. The production of such panels is done one at a time, with the formwork being erected on a flat surface, usually on the ground or a floor. After the concrete is poured into the formwork, it must be left for a period of time, at least until it has set sufficiently to be lifted without damage. A time period of two days is typical for 32 Mpa concrete until it reaches a strength of 25Mpa, at which time it may be lifted. Time periods for concrete of other strength will vary, and can be longer than two days. Once the panel reaches the required strength, the formwork side members are removed and usually require to be tapped with some force in order to be released from the concrete panel. It is therefore necessary that the formwork can be disassembled simply and easily, and in a manner whereby the side members retaining the concrete slurry are free to be knocked away from the panel, and reused.

Where a large number of panels is required for a project, it is necessary to prepare a substantial number of forms of identical size in order that the required number of panels can be produced in the time. These must be spread over a significant area which therefore requires a significant site area. If it is necessary to manufacture the panels under cover to ensure quality, the cost of providing a suitable shed also adds to the project cost. In addition, the need to construct identical formwork many times is also an added cost. As well, the need to be

able to pour concrete at many different places over a site is inefficient. Finally, the use of a substantial number of forms can result in considerable dimensional variations which cause problems during construction.

Disclosure of the Invention

Accordingly, the invention resides in formwork adapted for the consecutive formation of a plurality of panels, each subsequent panel being formed upon a previous panel, said formwork comprising a bed and a plurality of sides and corners at the intersections of the respective sides, the bed and side members defining a forming space for formation of a panel, at least one side member being supported by a pair of columns at the respective corners, each column having locating means adapted to receive and support the at least one side member at a plurality of locations along the length of the column, wherein the bed for a subsequent panel is defined by the upper surface of the previous panel and the side members extend from the upper surface of the previous panel to define the forming space for the subsequent panel.

According to a preferred feature of the invention, all side members are supported by an adjacent pair of columns.

According to a preferred feature of the invention, the panels are configured with a pair of substantially parallel faces and sides substantially transverse to said faces

According to a preferred feature of the invention, the spacing of the locations defines the thickness of respective panels between the parallel faces.

According to a preferred feature of the invention, the locating means comprise notches in an upright side of each column, the notches adapted to receive corresponding formations on the at least one side member, the side member being held in engagement with the upright side of the column.

According to a preferred embodiment, the shape of the notches is configured to correspond with the shape of the formation.

According to a preferred embodiment, at least one pair of opposing side members has a height corresponding to the thickness of the desired panel.

According to a preferred embodiment, the locations are positioned to support a side member in closely abutting relationship to an adjacent position.

According to a preferred embodiment, the panels are rectangular and the bed is rectangular.

According to a preferred feature of the invention, the column comprises a first upright member wherein the locating means is a plurality of notches spaced vertically along the upright member. According to a preferred embodiment, the column further comprises a second upright member pivotable about a base and by pivoting adapted to engage the at least one side member to fixedly secure said side member in locating engagement with the first upright member. According to a preferred embodiment, the column further comprises a member hingedly fixed adjacent the uppermost end of the second upright, the member adapted to swivel about the hinge to engage and thereby secure the second upright member to the first upright member to thereby clamp the side member into locating engagement with the first upright. second upright member is secured to the first upright member by a member adapted to pivot into about the engage the first upright member and the second upright member in the vicinity. According to a preferred embodiment, the top-piece is adjustable.

According to a preferred feature of the invention, the panels are separated by a coating, often referred to as a release agent or bond breaker, adapted to prevent a subsequent panel from adhering to a previous panel.

In accordance with a further aspect of the invention, there is provided formwork adapted for the consecutive formation of a plurality of panels, each subsequent panel being formed upon a previous panel, the formwork comprising support means, first side members to extend between respective pairs of support means, second side members to extend between respective pairs of support means, said first side members and said second side members to surround an space for

casting a panel, at least said first side members being vertically repositionable on said respective pairs of support means to, together with the upper surface of the previous panel, define a subsequent space for casting a subsequent panel, .

In accordance with another aspect of the present invention there is provided a method for the consecutive formation of a plurality of panels, each subsequent panel being formed upon a previous panel, the method comprising positioning first side members to extend between a respective pair of support means, positioning second side members to extend between a respective pair of support means, surrounding an area for casting a panel with said first side members and said second side members, pouring concrete into said area and allowing said concrete to set to form a panel, and vertically repositioning said first side members on said respective pair of support means to extend from the upper surface of the previous panel for casting a subsequent panel.

The invention will be more full understood in light of the following description of several specific embodiments.

Brief Description of the Drawings

The description is made with reference to the accompanying drawings of which:-

Figure 1 is a first isometric view of formwork in accordance with a first embodiment;

Figure 2 is a second isometric view of the formwork shown in Figure 1;

Figure 3 is a front elevation of a column of the formwork shown in Figure 1 configured for casting panels of a first thickness;

Figure 4 is a rear elevation of the column shown in Figure 3;

Figure 5 is a front elevation of a column of the formwork shown in Figure 1 configured for casting panels of a second thickness;

Figure 6 is a side elevation of an upright of the column shown in Figure 3 being supported by a prop;

Figure 7 is a partly exploded view of a column of the formwork shown in Figure 1;

Figure 8 is an isometric view of a column of the formwork according to a second embodiment;

Figure 9 is a partly exploded view of the column shown in Figure 8;

Figure 10 is a first isometric view of formwork in accordance with a second embodiment;

Figure 11 is a second isometric view of the formwork shown in Figure 10;

Figure 12 is an isometric view of an a first form of an intermediate support as used in the second embodiment;

Figure 13 is an isometric view of a second form of an intermediate support as used in the second embodiment;

Figure 14 is an isometric view of a column of the formwork according to a third embodiment;

Figure 15 is a cross-section of a side member for use with the third embodiment;

Figure 16 is a cross-section of an alternative side member for use with the third embodiment;

Figure 17 is a third isometric view of the formwork shown in Figure 10;

Detailed Description of Preferred Embodiment

The embodiments of the invention are directed to formwork which is adapted for the consecutive formation of a plurality of panels, each subsequent panel being formed upon a previous panel.

Formwork is the term used to define the temporary structure having a space into which concrete is poured and wherein it sets and by which the shape of the concrete form is defined, and it is used with this meaning within this specification.

A first embodiment of the invention is depicted In Figures 1 and 2 wherein there is shown formwork 1 comprising a rectangular bed 3 comprising a level surface suitable for receiving concrete. Positioned at each corner between the sides of the bed 3 is a column 2. A pair of opposed, side members 4 extend between respective pairs of columns 2 to define the sides of the formwork space. A pair of opposed end members 6 extend between a respective pair of columns 2 to define the ends of the formwork space. Typically, the end members are plywood. The side members 4 and the end members 6 surround an area 8 for casting a panel 10a. The side members 4 are vertically repositionable on the columns 2 for casting subsequent panels 10b, 10c, etc.

As shown in more detail in Figures 3 to 7, each column 2 comprises a pair of uprights 12a, 12b, a base plate 14, a top-piece 16 and two fins 18. Each fin 18 is mountable on a respective upright 12a, 12b. Each top-piece 16 comprises a cross-piece 20, a locating pin 22 extending transversely adjacent one end of the cross-piece 20 and a locking pin 24 connected at the other end of the cross piece 20 by a hinge 26.

One of the uprights 12a is fixed to the base plate 14. The other upright 12b is connected to the base plate 14 by a hinge 28.

The locking pin 24 slides into the top of the fixed upright 12a. The locating pin 22 is received in the top of the hinged upright 12b.

Each fin 18 is provided with collars 30 on a first face thereof. A fin 18 can slide over an upright 12a, 12b with the upright 12a, 12b being received in the collars 30.

Each fin 18 is provided with a series of spaced notches 32 along each longitudinal edge thereof. The notches 32a along a first edge of each fin 18 are spaced apart a first distance whilst the notches 32b along a second edge of each fin 18 are spaced a second distance.

Fins 18 are provided with notches 32 having spacings that match the thicknesses of panels 10 that it is desired to construct using the formwork 1.

Props 34 are provided to retain the columns 2 in an upright condition. The uprights 12a are provided with holes 36 for locating the props 34. The props 34 have base plates 40.

The fins 18 are provided with holes 37 for connection of the end members 6 with the fins 18 of respective pairs of columns 2.

Side members 4 are typically made from square section steel tubing but alternatively may be made from extruded plastics, extruded aluminium, timber or other suitable material. When made of steel tubing, each side member 4 comprises a beam of box section having longitudinal support ribs 38 extending longitudinally at each corner thereof. The longitudinal support ribs comprise steel strips welded to the steel tubing. When the side member 4 is made from an extruded material such as plastics, the longitudinal support ribs 38 may be formed integrally.

The manner of assembly of the formwork 1 of the present invention will now be described.

Fins 18 are selected and placed on the uprights 12a, 12b of a first pair of columns 2 such that the innermost notches 32, i.e. the notches 32 that face each other, have the same spacing; that spacing is equivalent to the required

thickness of the panels 10 to be constructed. The column 2 shown in Figures 3 and 4 has fins 18 mounted on the uprights 12a, 12b such that the notches 32a of the respective fins 18 face each other. In contrast, the column 2 shown in Figure 5 has fins mounted on the uprights 12a, 12b such that the notches 32b of the respective fins 18 face each other. The spacing between the notches 32a is greater than the spacing between the notches 32b. Thus, using notches 32a produces a panel 10 having a greater thickness than when notches 32b are used.

The fins 18 can be installed on the uprights 12a, 12b of each column 2 by removing the top-piece 16 and sliding each fin 18 over a respective upright 12a, 12b. The respective top-piece 16 is then returned to each column 2 such that the locking pin 24 is received into the top of the fixed upright 12a and the locating pin 22 is received into the top of the upright 12b.

The columns 2 are arranged in a face-to-face relationship, and spaced apart by a distance approximately equal to the length of the panels 10 to be constructed. The columns 2 are arranged such that the faces of the fins 18 that do not carry the collars 30 face each other.

A side member 4 is positioned so that it extends between a pair of columns 2. This is done by pivoting the cross-piece 20 upwardly, in the direction of arrow A shown in Fig. 7, via the hinge 26 such that the locating pin 22 disengages from the upright 12b of each of the columns 2. Each upright 12b is then pivoted away from the uprights 12a by the hinges 28in the direction of arrow B as shown in Fig. 7. The side member 4 can then be positioned between the uprights 12a, 12b of the pair of columns 2. The longitudinal support ribs 38 of the side member 4 locate in the notches 32 of the fins 18. The upright 12b of each column 2 is then returned to the vertical position by pivoting it in the direction toward a respective upright 12a as shown by arrow C in figure 7. The cross-piece 16 is then pivoted downwardly in the direction of arrow D as shown in figure 7 such that the locating pin 22 locates in the upper part of the upright 12b of each column 2. The side

member 4 is then positioned such that it extends between a respective pair of columns 2 adjacent respective base plates 14 thereof.

A second pair of columns 2 is positioned in a manner similar to that previously herein before described. The second pair of columns 2 is positioned to receive a second side member 4 which is positioned substantially parallel to the side member 4. The spacing between the first and second side members 4 and respective opposed columns 2 of the first and second pair of columns 2 determines the width of the panels 10 to be constructed.

The second side member 4 is positioned to extend between the second pair of columns 2 in a manner similar to that hereinbefore described with reference to the side member 4 and first pair of columns 2.

The first and second pairs of columns 2 are arranged such that the fixed support 12a of opposed columns 2 are opposed to each other.

End member 6 is then connected between respective uprights 12a of each pair of opposed columns 2. This is done by way of holes 37 in the fins 18 of the columns 2. Fixing screws pass through the holes 37 and end members 6 to fix the end members 6 to the fins 18 of the columns 2.

The side members 4 and end members 6 surround an area 8 for casting a panel.

Once the columns 2, side members 4 and end members 6 have been correctly positioned for casting the panels 10, the columns 2 may be secured in place by passing screws through holes 37 in the base plates 14 and securing to the ground.

The props 34 are then positioned to support the columns 2. Screws may be driven into the ground through holes in base plates 40 of the props 34.

The formwork 1 of the present embodiment does not have any intermediate support member or barrier between each pair of columns 2 that support a side member 4. This avoids an impediment to the levelling process.

By following the above assembly procedure, the formwork 1 has been assembled in the condition shown in figure 1. The formwork 1 is then ready to receive the casting of a first panel 10a.

Prior to casting, a release agent or bond breaker is applied to the ground. Reinforcing members (not shown) are placed in position in the space 8. Concrete is then poured into the space 8 substantially up to the height of the edge of the longitudinal support ribs 38 of the side members 4. The concrete is then allowed to settle. A vibrating screed can be used to create a smooth and level upper surface to the concrete pour. Such vibrating screeds are known in the art. The vibrating screed can be provided so that it extends across the concrete pour from one side member 4 to the other. Since there are no intermediate support members or other barriers between each pair of columns 2 that support a respective side member 4, the vibrating screed can be positioned adjacent one of the end members 6 and moved in a continuous motion along the surface of the poured concrete toward the other end members 6.

The concrete pour is then allowed to set and cure to form a first panel 10a.

After the first panel 10a has been formed, the side members 4 are repositioned for casting the next panel 10b. This is done by first pivoting the cross pieces 16 upwardly in the direction of arrow A shown in figure 7. The uprights 12b are then pivoted away from the uprights 12a in the direction of arrow B shown in figure 7. This permits access to the side members 4 so that they can be removed from their existing positions and moved upwardly to the next pair of notches 32. The uppermost notches 32 used when casting the first panel 10a become the lowermost notches 32 for casting the second panel 10b. The uprights 12b are returned to their vertical condition and the cross pieces 16 returned to their horizontal position so that the locating pins 22 locate in their respective uprights 12b. This brings notches 32 of both uprights 12a and 12b into engagement with

the longitudinal support ribs 38 of the side members 4 such that the side members 4 are supported.

A coating of release agent or bond breaker is then applied to the upper surface of the first panel 10a. Concrete is then poured on top of the first panel 10a to form the second panel 10b and any reinforcing material is also placed into position before the concrete is poured. This is done in a manner similar to that for the first panel 10a.

At the conclusion of the formation of successive panels 10, the side members 4 are vertically repositioned on the columns 2 for casting subsequent panels 10. Figure 2 shows a condition of the formwork 1 in which three panels 10a, 10b, 10c have been cast and the side members 4 have been repositioned ready for casting of a fourth panel 10 on top of the third panel 10c.

Once the required number of panels 10 has been cast using the formwork 1, the formwork 1 is disassembled by removing the side members 4, uprights 2 and end members 6 to leave a stack of panels 10. The panels 10 may then be lifted using suitable lifting equipment. Due to the use of the release agent or bond breaker, each panel 10 can be readily removed and lifted from the panel 10 beneath it.

The absence of any support members or barriers between each pair of columns 2 that support a side member 4 allows easy access to the vibrating screed to traverse the length of the concrete that has been poured for casting each panel 10.

A second embodiment of the invention functions in the same manner as that of the first embodiment, but the design of the columns 2 is changed. The columns of the second embodiment are depicted in Figures 8 to ??.

As shown in Figure 8 and 9, each column 102 comprises a base 114, an upright 112, an upright stub 124, a top-piece 116 and a fin 118. The base 114 comprises two lengths of right-angle section steel joined together transversely at

a respective end of each and arranged such that one face of each section are co-planar and adapted to rest on the support surface or ground. A length of flat section steel strip extends out from the intersection of the two angled lengths parallel with one of them, again co-planar with them to rest on the support surface to provide a support foot 123. A short length of square section steel tubing is welded to the support foot 123 in an upright orientation, adjacent to the intersection to provide an upright stub 124. The fin 118 comprises an elongate flat-steel strip having notches of configuration similar to the fin 18 of the first embodiment. A support tube 125 of square section steel of equivalent length to the fin 118 is welded to one face of the fin 118, extending the full length thereof. The fin 118 is thereby adapted to engage the stub 124 from either end of the support tube 125 by the respective end of the support tube 125 passing over the stub like a sleeve. A locking bolt 126 is provided near each end of the support tube 125 to clamp the fin 118 in firm engagement with the stub 124.

After engagement with the stub 124, adjustable struts 127 extend from a support bracket 130 midway between the ends of the support tube 125 to the right-angle arms 121 of the base 114, thereby providing rigid support. The support struts 127 comprise steel tubes 128 of square section having a threaded socket at either end to receive threaded tie-rods 129, that is, rods which are adapted to be pivotally supported at one end to provide securing means, secured to the bracket 130 of the support tube 125 at one end and to an arm 121 of the base 114 at the other end. The threads of the two tie-rods 129 are of opposite twist so that the length of struts 127 can be adjusted when assembled be rotation of the steel tubes 128, in the same manner as a turnbuckle.

The upright 112 is a length of square section steel tubing hingedly connected to a slotted base member 131 at its lower end and hingedly connected to a top-piece 116 at its upper end. The slotted base member 131 is adapted to be adjustably secured to the support foot 123 by a locking bolt 132. The top-piece 116 comprises an adjustable cross-piece and a locating pin 133. The cross-piece comprises a first cross-member 141 and a second cross-member 142, both of square steel section tubing of differing cross-section, the second cross-member

142 telescopically engaging the first cross-member 141. A lock-bolt 143 is provided through the wall of the first cross-member 141 proximate the end opposed to the hinge to lock the second cross-member 142 relative to the first cross-member 141. The locating pin 133 extends transversely adjacent the end of the second cross-member 142 disposed from the upright 112.

The fin 118 is provided with a series of spaced notches 144 along each longitudinal edge thereof. The notches 144a along a first edge of each fin 118 are spaced apart a first distance whilst the notches 144b along a second edge of each fin 118 are spaced a second distance. The side of the fin to be used is selected by selecting which end of the support tube 125 to insert over the stub 124.

As shown in Figure 10, in use the base 114 is bolted to the floor at a corner of the bed 3, as for the first embodiment. The side member 4 is passed between the upright 112 and the fin 118 and the ribs 38 disposed in adjacent notches of the fin 118. The slotted base member 131 of the upright 112 is positioned by moving it relative to the support foot 123 and securing the lock-bolt 132. Upright 112 is swivelled about the hinge and the top-piece 116 swivelled so that the locating pin 140 is dropped into the open end of the support tube 125. The top-piece 116 is adjusted so that the upright 112 is firmly pressed against the side member 4 to hold it against the fin 118. It is to be noted that the second embodiment differs from the first in that the upright 112 does not support a finned or notched member but that the upright which has a planar face facing the fin 118 which presses directly against the side member.

In cases where the panel is reasonably long, it has also been found desirable to provide intermediate support to the side members to maintain the dimension of the panels accurately, as shown in Figures 10 and 11. In Figure 12 there is depicted an adjustable strut 161 suitable for this purpose. The strut 161 comprises a pair of telescoping steel tubes 162 and 163 of square section, the outer tube 162 supporting a lock bolt 164 to lock the two members relative to each other. Each member 162 and 163 is provided with a threaded socket at the

distal end to receive threaded tie-rods 165. The lower tie-rods is secured to a base unit 166 about which it can swivel. In use, the base unit is bolted to the support surface. The upper tie-rod 165 is secured to a bracket 167 adapted to engage a longitudinal support rib 38 of the side member 4. The bracket 167 comprises a length of rectangular steel strip bent at one end 168 at approximately 45 degrees, the end 168 being folded over itself to provide a notch 169 adapted to receive the longitudinal support rib 38. A pair of parallel plates 170 extend transversely from the strip and have apertures to receive a bolt 171 to secure the upper tie-rod. In addition, a chain 172 is connected to the bolt 171 and then through a turnbuckle 173 to another base plate 174 secured to the support surface substantially below the bracket 167. The chain 172 is required to prevent the strut 161 from pushing the bracket 167 and/or the side member 4 upwards.

The threads of the two tie-rods 171 are of opposite twist so that the length of struts can be finely adjusted when assembled by rotation of the steel tubes 162/163.

In use, after the side member 4 has been positioned in the columns , the bracket of the intermediate support is positioned over the longitudinal support rib 38 and telescoping members adjusted and locked by the lock bolt. The chain 172 is also adjusted by means of a hook on the turnbuckle 173 and then fine adjustments made to the strut 161 by rotating the tubular members 162/163 relative to the tie-rods 171 and the chain 172 by rotating the turnbuckle 173. The side members 4 can thus be set with a high level of accuracy and further adjustments can be made if necessary immediately after the concrete is poured into the formwork. As well, the bracket 167 does not interfere with the levelling process as it does not stand above the level of the concrete which forms the panel to an extent that causes inconvenience.

An alternative intermediate support is depicted in Figure 13. The support of this embodiment comprises a base 181 comprising a length of right-angle steel secured to the support surface and a tubular upright 182 of circular cross-section

upstanding substantially vertically from the base 181. An engagement bracket 183 is associated with the tubular upright 182. The engagement bracket 183 comprises a sleeve 184 adapted to be received over the tubular upright 182 supporting an engagement plate 185 extending from the sleeve 184. A lock bolt 186 is mounted to the sleeve to lock the sleeve relative to the tubular upright 182. The plate 185 is substantially the same width vertically when mounted to the upright 182 as the thickness of the panel and is chamfered at its two corners disposed from the sleeve to accommodate the longitudinal support ribs 38 of the side member 4.

In use, the support base 181 is secured to the support surface close to the panel side. After the side member 4 is mounted, the engagement bracket 183 is rotated around the tubular upright 182 until it engages the side member 4 and is positioned vertically so that the engagement plate 185 accurately coincides with the side member 4. The engagement plate 185 may then be tapped into position with a suitable hammer to ensure firm engagement and locked in position.

This second type of intermediate support has the disadvantage that the tubular upright interferes with the levelling process of the panel, but is particularly suitable when there is little room at the sides of the panel, which might prevent use of the former type of intermediate support.

The first and second embodiments cause the panels to be produced with chamfered edges as a result of the longitudinal support ribs 38 which extend diagonally out from the side member 4. This is often desirable, but where it is not, a third embodiment is provided as shown in Figures 14.

The third embodiment is similar to the second embodiment so in the drawings like numerals are used to denote like parts. In the third embodiment, the fin 218 is provided with a plurality of slots 244 transverse to the vertical edge 213 in place of the notches 144 of the second embodiment. A side member of square section steel is provided having a rib extending from one face of the side member only to contact the fin 211 and arranged to be co-planar with that face to thereby be adapted to engage one of the transverse slots. The width of the side

member can be selected to be slightly greater than the thickness of the desired panel being produced so that when forming a subsequent panel the side member slightly overlies the previous panel. In this embodiment, the distance between slots does not represent the thickness of the panel as a larger number of slots may be made in the edge of the fin to accommodate a wider range of panel thickness.

In an adaptation of the side member, as shown in Figure 15, a second rib 206 extends from the corner of the side member 204 diagonally opposed to the corner at which the first rib 205, just described, extends, the two ribs extending transversely relative to one another.

In a yet further adaptation as shown in Figure 16, the two ribs comprise metal strips 305 bolted to the side member 304 through slotted apertures in the strips 305 so that the amount by which the strip extends out from the side member is adjustable.

The formwork according to the embodiments may be used to make pre-cast and tilt-up concrete panels for walls and other applications.

The formwork according to the embodiments exhibit a number of advantages over conventional construction techniques. Firstly, a number of panels can be cast in the one location on a site. This results in a significant saving in size of the site required. It also means that concrete is poured in fewer positions than is required conventionally. Secondly, the usage of a particular location is greatly increased. As mentioned earlier, conventionally, panels must be left for about two days before they can be moved and a new panel poured. With the technique of the embodiments, it is not necessary to wait until a previous panel has cured before the next can be poured, it is only necessary that is has hardened sufficiently to support the next panel. It has been found that two or even three panels can be poured in a day. This is very significant increase in efficiency of site usage. The embodiments also enable rapid re-configuration for casting subsequent panels and also ensure panels have a very consistent thicknesses.

Finally, the above description explains how the embodiments provide for the production of panels of identical size. The embodiments may also be used for production of subsequent panels having reduced size. Figure 17 depicts a configuration according to the second embodiment wherein three panels of identical size have previously been prepared. In this arrangement the width of the next panel is reduced by moving two of the columns supporting one of the side members towards the other side the required amount. Because the thickness of the panel is determined by the side member 2, consistency in thickness is maintained.

While the above description refers to embodiments having rectangular or square profile, the invention is not limited to such an arrangement and panels having three, five, six or even more sides may be formed using the technique. Where the panel has an odd number of sides, adaptations of at least one of the columns described above would be required to receive and position side members from each side of the column.

The length of this panel is also reduced by placing a board 411 of plywood or similar temporary panel at the appropriate location and supporting it by angle brackets 412. The angle brackets 412 are secured by suitable means to the previous panel.

This technique gives considerable flexibility in manufacture and may be important for smaller projects, or where a small number of odd-sized panels are required.

Modifications and variations such as would be apparent to a skilled addressee are deemed to be within the scope of the present invention. For example, the end members or non-adjustable side members need not be supported by the columns but instead might be supported by an alternative support means.

Throughout the specification, unless the context requires otherwise, the word "comprise" or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

The claims defining the invention are as follows:

1. Formwork adapted for the consecutive formation of a plurality of panels, each subsequent panel being formed upon a previous panel, said formwork comprising a bed and a plurality of sides and corners at the intersections of the respective sides, the bed and side members defining a forming space for formation of a panel, at least one side member being supported by a pair of columns at the respective corners, each column having locating means adapted to receive and support the at least one side member at a plurality of locations along the length of the column, wherein the bed for a subsequent panel is defined by the upper surface of the previous panel and the side members extend from the upper surface of the previous panel to define the forming space for the subsequent panel.

2. Formwork as claimed at claim 1 wherein all side members are supported by respective adjacent pairs of columns.

3. Formwork as claimed at claim 1 or claim 2 wherein the spacing of the locations defines the thickness of respective panels.

4. Formwork as claimed at any one of the previous claims wherein at least one pair of opposing side members has a height corresponding to the thickness of the desired panel.

5. Formwork as claimed at any one of the previous claims wherein the locating means comprise notches in an upright side of each column, the notches adapted to receive corresponding formations on the at least one side member, the side member being held in engagement with the upright side of the column.

6. Formwork as claimed at claim 1 wherein the shape of the notches is configured to correspond with the shape of the formation.

7. Formwork as claimed at any one of the previous claims wherein the locations are positioned to support a side member in closely abutting relationship to an adjacent position.

8. Formwork as claimed at any one of the previous claims wherein the column comprises a first upright member wherein the locating means is a plurality of notches spaced vertically along the upright member.

9. Formwork as claimed at claim 8 wherein the column further comprises a second upright member pivotable about a base and by pivoting adapted to engage the at least one side member to fixedly secure said side member in locating engagement with the first upright member.

10. Formwork as claimed at claim 9 wherein the second upright member is secured to the first upright member by a pivotable top-piece adapted to engage the upper portions of the first upright member and the second upright member. According to a preferred embodiment, the top-piece is adjustable.

11. Formwork as claimed at any one of the previous claims wherein the panels are rectangular and the bed is rectangular.

12. Formwork as claimed at any one of the previous claims wherein the panels are separated by a coating, often referred to as a release agent or bond breaker, adapted to prevent a subsequent panel from adhering to a previous panel.

13. Formwork as claimed at any one of the previous claims wherein the panels are configured with an upper face and a lower face that are substantially parallel, the lower face being defined by the bed, and sides being substantially transverse to said upper and lower faces.

14. Formwork adapted for the consecutive formation of a plurality of panels, each subsequent panel being formed upon a previous panel, the formwork

comprising support means, first side members to extend between respective pairs of support means, second side members to extend between respective pairs of support means, said first side members and said second side members to surround an space for casting a panel, at least said first side members being vertically repositionable on said respective pairs of support means to, together with the upper surface of the previous panel, define a subsequent space for casting a subsequent panel.

15. Formwork as claimed at claim 14 wherein each support means is provided with locating means adapted to receive and support at least one side member at a plurality of locations along the length of the support means, each location supporting the respective side member in coplanar relationship to its position in other of the locations.

16. Formwork as claimed at claim 15 wherein the spacing of the locations defines the thickness of respective panels.

17. Formwork as claimed at any one of claims 14 to 16 wherein the locating means comprise notches in an upright side of the support means and at least alternate side members are provided with at least one rib receivable by the notches.

18. Formwork as claimed at any one of claims 14 to 17 wherein at least the first side members or the second side members have a height corresponding to the thickness of the desired panel.

19. A method for the consecutive formation of a plurality of panels, each subsequent panel being formed upon a previous panel, the method comprising positioning first side members to extend between a respective pair of support means, positioning second side members to extend between a respective pair of support means, surrounding an area for casting a panel with said first side members and said second side members, pouring concrete into said area and allowing said concrete to set to form a panel, and vertically repositioning said first side members on said respective pair

of support means to extend from the upper surface of the previous panel for casting a subsequent panel.

20. A method as claimed at claim 18 wherein each support means is provided with locating means adapted to receive and support at least one side member at a plurality of locations along the length of the support means.

21. A method as claimed at claim 19 wherein the spacing of the locations defines the thickness of respective panels.

22. A method as claimed at any one of claims 19 to 21 wherein the locating means comprise notches in an upright side of the support means and at least alternate side members are provided with at least one rib receivable by the notches.

23. A method as claimed at any one of claims 19 to 22 wherein at least the first side members or the second side members have a height corresponding to the thickness of the desired panel.